SECTION 4

Noise

Section Contents

Noise Health Effects and Controls

What is Noise?

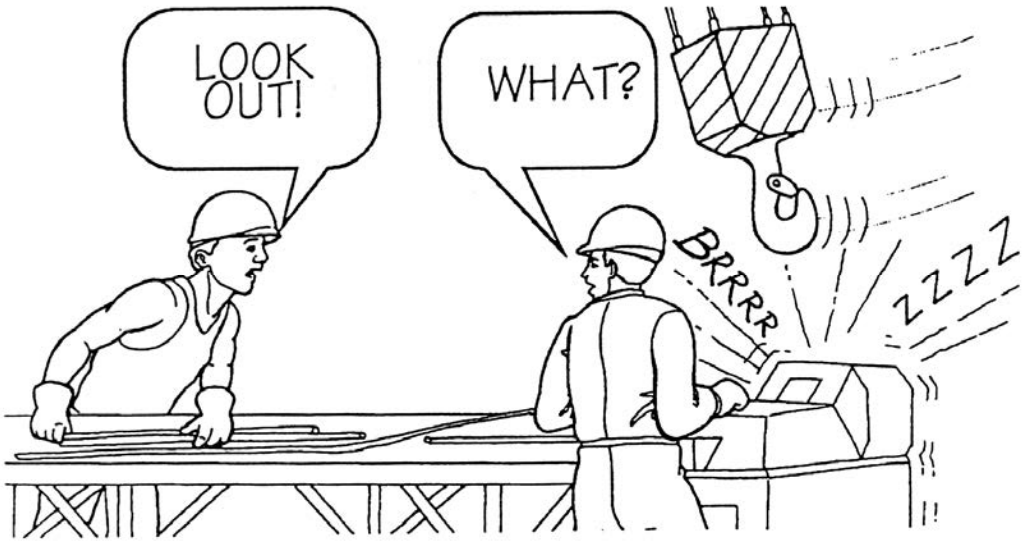
Is conversation with friends and family noise?

Is music noise?

Is a factory machine running at high-speed noise?

The only difference between music and factory sounds is whether the sound is desired – in most cases the music is wanted sound and the factory noise is unwanted sound. Noise is defined as "unwanted sound." There are many sources of noise in the workplace. These include machinery which have moving parts and metal-on-metal contacts; vehicles; pumps and compressors; air hoses; and many others.

However, even the most desired music can be just as damaging to the human ear as the worst factory noise. The health effects depend on the loudness of the sound, not whether the sound is wanted or not.



How much is "too much" noise?

Simple ways of determining if noise levels at work are too high include:

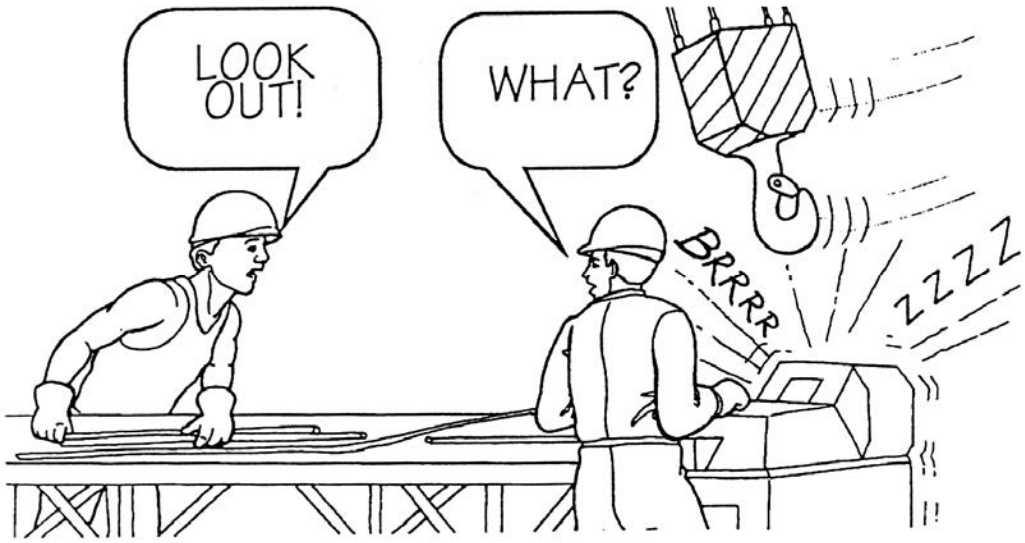
- if you have to yell or speak loudly to be understood at an arm's length away from someone else
- if your ears are ringing when you leave the area
- if you have difficulty hearing a normal conversation after work
- if you get headaches or feel dizzy from the noise
- if any of your co-workers also have these problems or have been diagnosed with hearing problems by a doctor.

Health Effects of Noise

High levels of noise can have both immediate and long-term effects on hearing. High noise levels can cause:

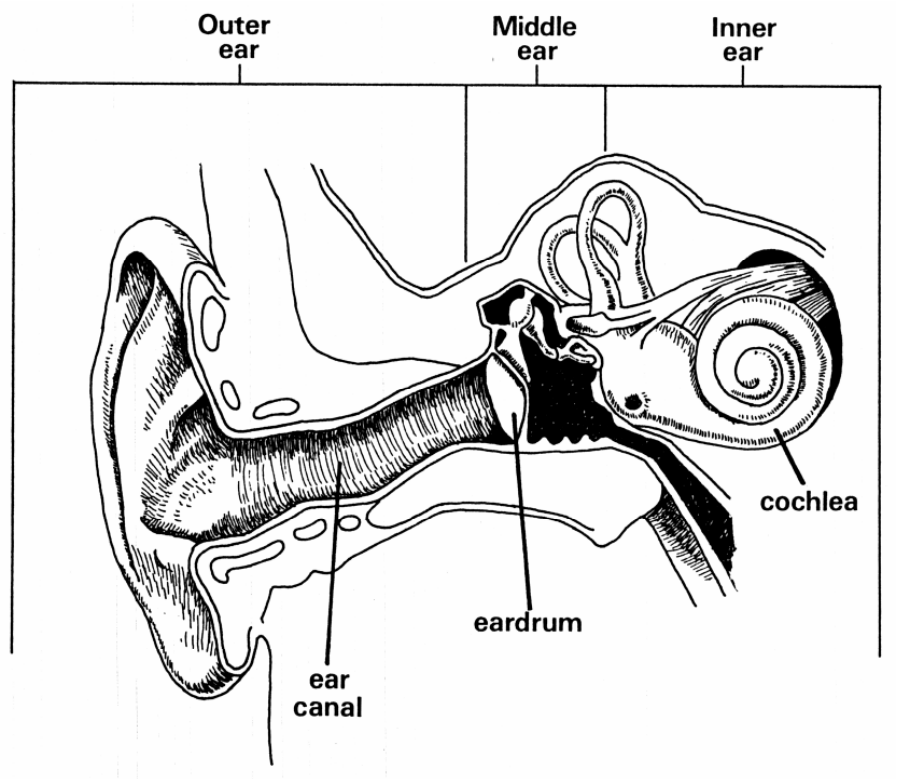
- hearing loss, both temporary and permanent
- headaches
- dizziness
- high blood pressure
- nervousness and stress, leading to stomach ulcers, sleeping problems, and heart disease
- loss of concentration
- accidents if warning alarms or shouts are not heard

The level of damage to the ear can be determined by hearing tests called “audiograms.” Loss of hearing in the range of sound where human speech occurs (between 2,000 and 4,000 Hertz) has temporary and permanent effects.



Anatomy of the Ear

The anatomy of the ear consists of the outer ear, the middle ear and the inner ear.



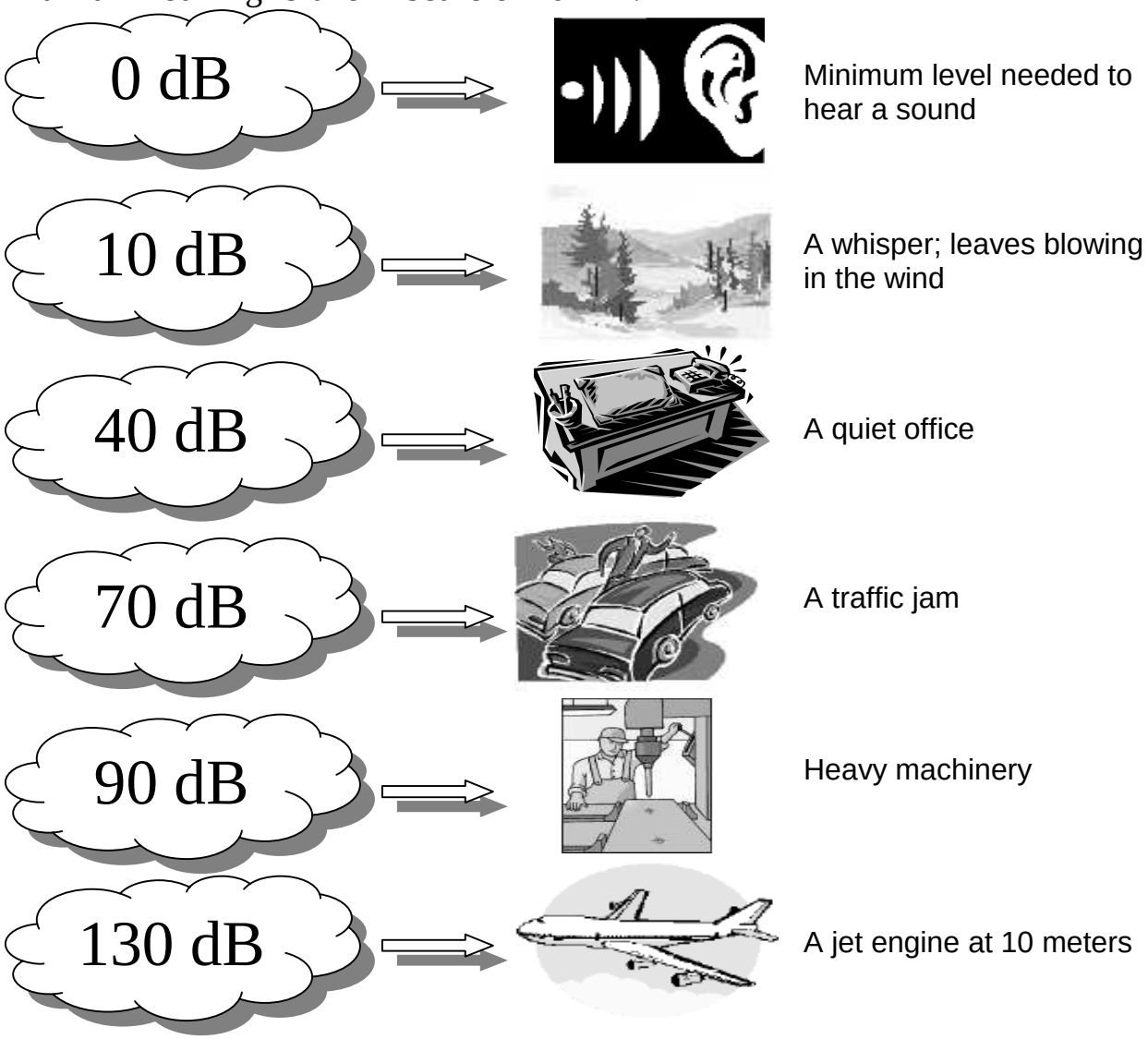
There is a spiral-shaped bone in the inner ear called the cochlea, which is lined with tiny hair cells. Sound waves are transmitted via the outer ear, through the middle ear, to the inner ear. In the inner ear, the sound wave pressure moves the hair cells, which then send messages to the brain, via the nervous system, about the sounds heard by the ear.

High noise levels will damage the hair cells in the inner ear and reduce the ability of the ear to "hear" sounds and transmit the information to the brain. Once the hair cells in the inner ear have been damaged, there is no way to repair the damage – hearing loss is permanent!

Measuring Noise Levels: What Are Decibels?

Decibels

Noise is measured in units called “decibels” which is a measure of how much pressure is created by the sound wave producing the sound. The range of decibels is from 0 to about 140, or from the smallest sound human ears can hear to the sound level that will do immediate and permanent damage to the ear. The word “decibels” is abbreviated as “dB” and there are three scales – A, B and C – but the scale closest to human hearing is the A scale or “dBA”.

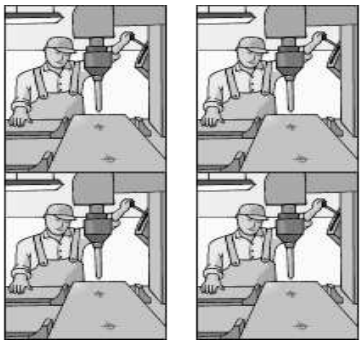


Decibels are measured on a special scale – a logarithmic scale where every increase in 3 decibels actually doubles the intensity of the sound. That means that an increase from 90 decibels to 93 decibels means the sound is twice as loud. Increase from 90 dBA to 96 dBA would mean the sound level is four times as loud.

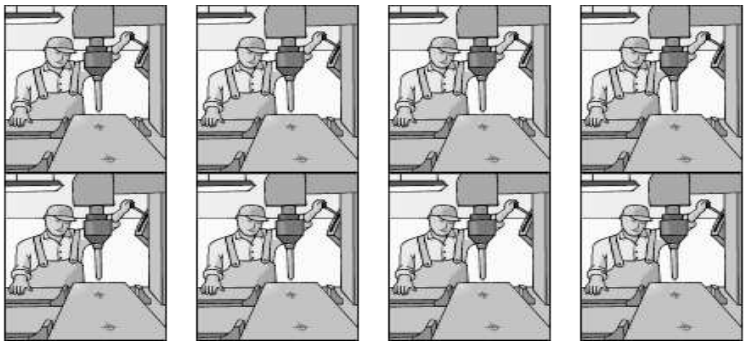
90 dB=

93 dB=

96 dB=



99 dB=

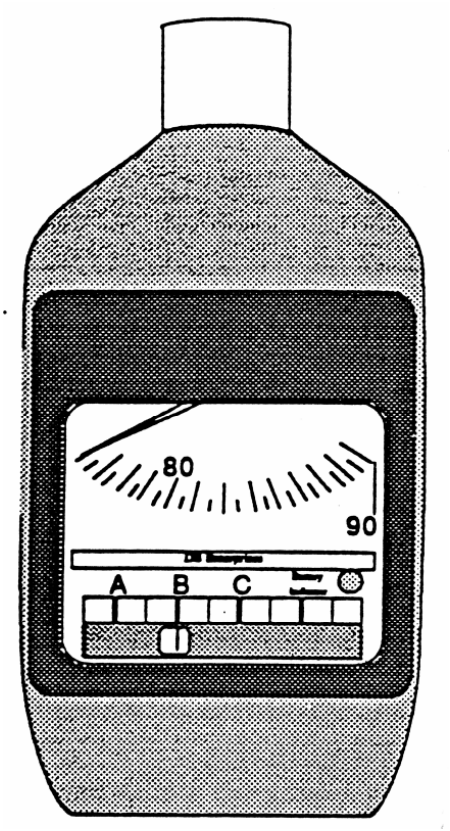


The important thing to remember is that a small increase in decibels means a large increase in the sound level and the damage it can do to the ear.

Monitoring Workplace Noise Levels

Two kinds of measurements can be taken to determine noise levels in the workplace.

Direct Reading Instruments: Sound Level Meter



Use: To monitor noise exposure. A Sound Level Meter (SLM) is a direct-reading instrument.

Read-out: Decibels (dB), usually on the A-Scale. The A-Scale has been developed to mimic the way the human ear responds to noise.

Precautions:

Requires calibration before and after each use.

Some instruments require manually changing the range of noise that can be measured.

Battery must be checked before use.

General-purpose meters are designed to measure only continuous noise (sounds which last at least 1 second).

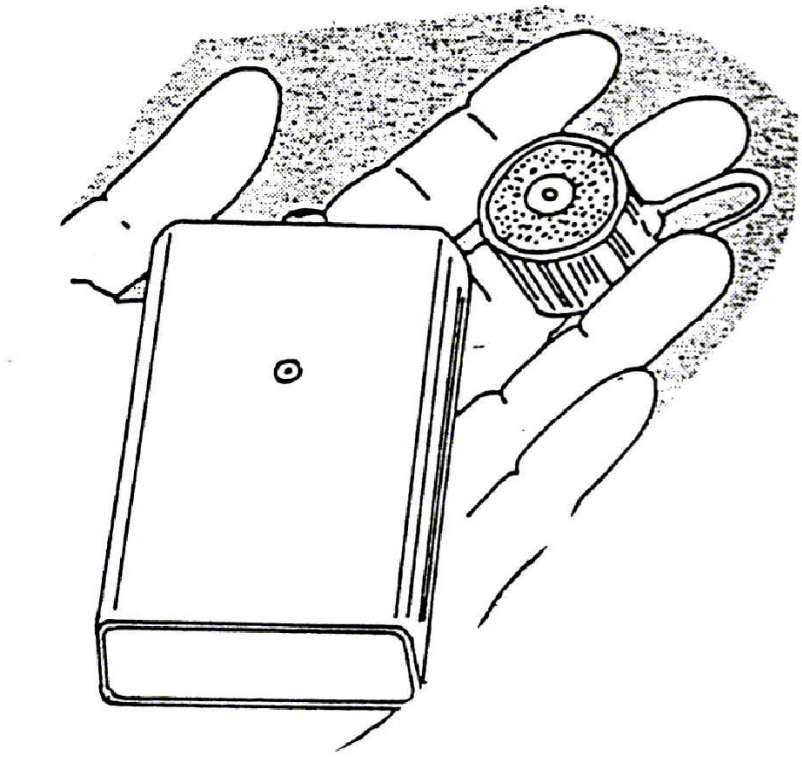
Dial must be constantly viewed while using.

Personnel must be trained to use instrument.

Personal Dosimeter

A "personal dosimeter" is used to determine the full shift exposure for a worker. This should cover the entire work shift – 8, 10 or 12 hours, or however long the shift is. The dosimeter is placed on the worker's belt and a small microphone is located near the worker's ear. The dosimeter measures the amount of sound the worker hears over the entire work shift.

Both sound level meters and personal dosimeters give a numerical result that can be compared to the occupational exposure limit of 85 dBA for an 8-hour shift, 40-hour work week (lower for longer shifts).



Noise Dosimeter - for a time-weighted average

Occupational Exposure Limits for Noise

There are OELs for noise exposures in workplaces in China. The noise OELs are also based on an 8 hour work day and 40 hour work week. There are no noise OELs for longer shifts and work weeks, but, as with long shift chemical exposures, the employer's obligation is to reduce noise exposures to as low as possible.

The noise regulations in China are:

Occupational Exposure Limits
Maximum Permissible Noise Levels*

Location in the Workplace	Maximum Permissible Limits - in decibels (dBA)
Workshops (8 hour shift)	90/85 **
Observation room, Break room	75
Computer room	70
Office, laboratory, design room	70
Control Center, telephone switchboard, fire monitoring station	60
Conference room	60
Medical clinic, classroom, daycare center	50

* = Limits as per GB J87-85 Design Standards of Industrial Noise in Factories (1985)
** = The limit for existing factories is 90 dBA while the limit for new factories is 85 dBA.

The process of evaluating noise exposures is the same as with chemical exposures. The monitoring results are compared to the OEL, and the employer must take action to reduce the noise levels if the exposures are above the OEL.

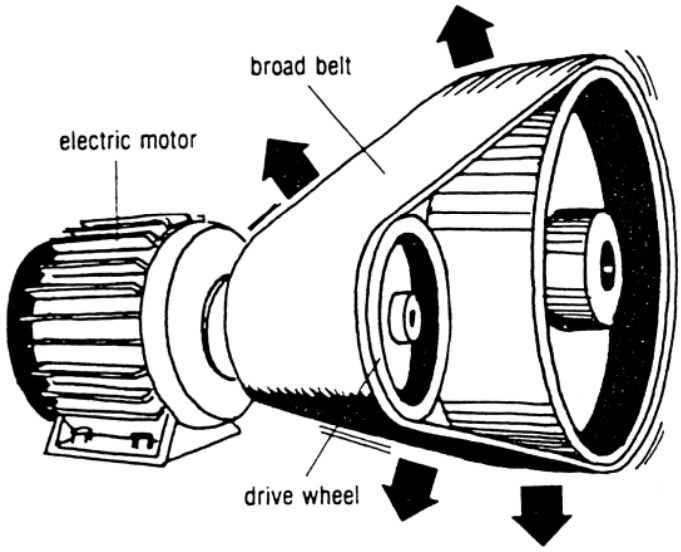
Controlling Noise Levels

If noise levels are found to be above 85 dBA for an 8-hour shift, 40-hour workweek, the employer is required by law to reduce the noise levels.

Engineering controls at the source of the noise are the most effective means of reducing noise levels. The controls should always control the loudest source of the noise first. Engineering controls include:

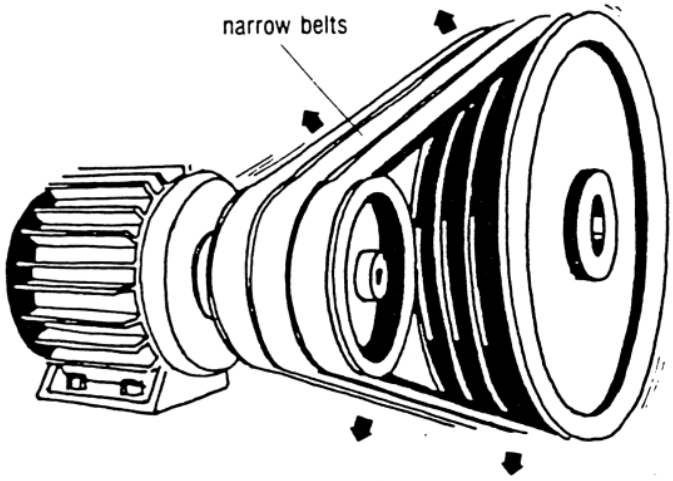
- redesign equipment to reduce the speed or impact of moving parts; to install mufflers on intakes and exhausts; to replace old equipment with newer, better designed equipment;
- service and maintain equipment to replace worn parts and to lubricate all moving parts;
- isolate equipment either by distance, by enclosures or by barriers;
- damping and cushioning noise sources by using rubber pads to reduce vibration and noise coming from metal parts; by reducing the drop height of objects falling into bins or onto belts;
- absorptive baffles hung in work areas to absorb sounds generated there.

Examples of Engineering Controls



Example : Problem

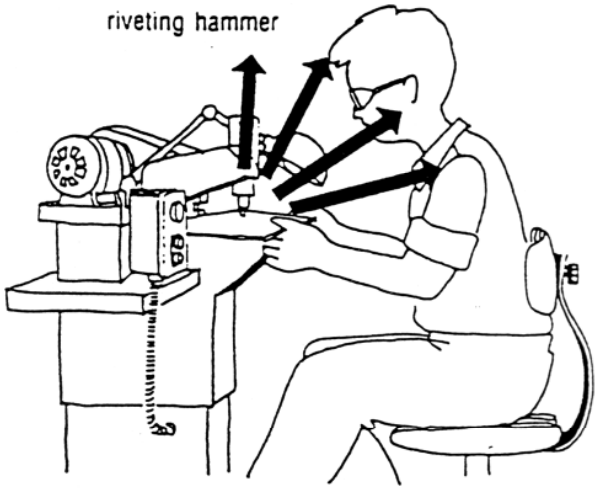
A belt drive provides a large amount of low frequency noise because of the vibration of the broad belt.



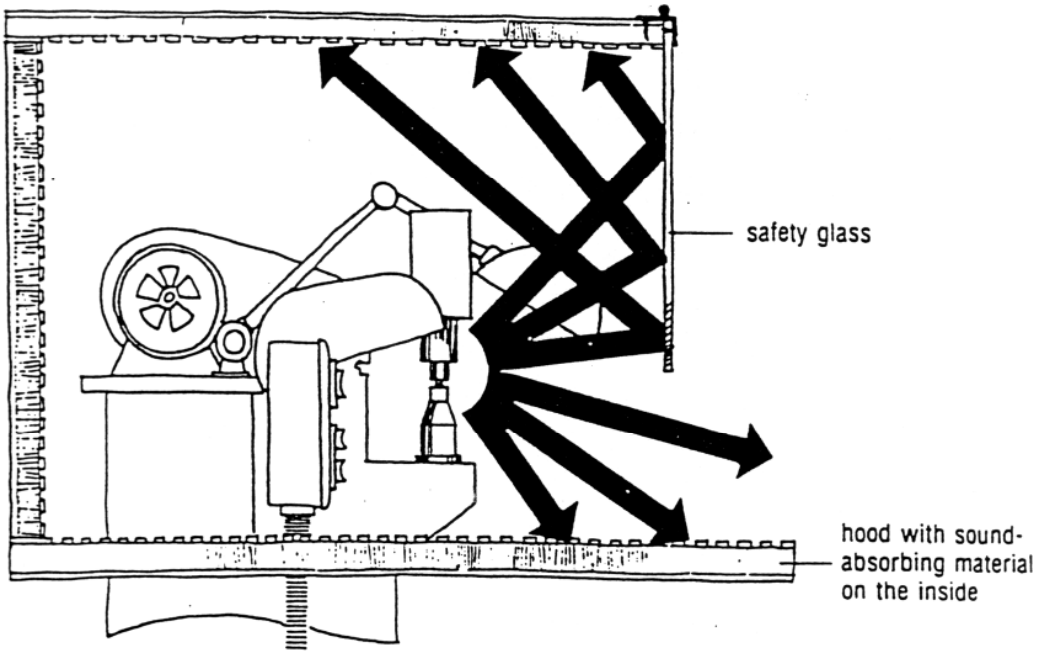
Control measure

The broad drive belt is replaced by narrower belts, separated by spacers. This reduces the noise problem.

Problem:

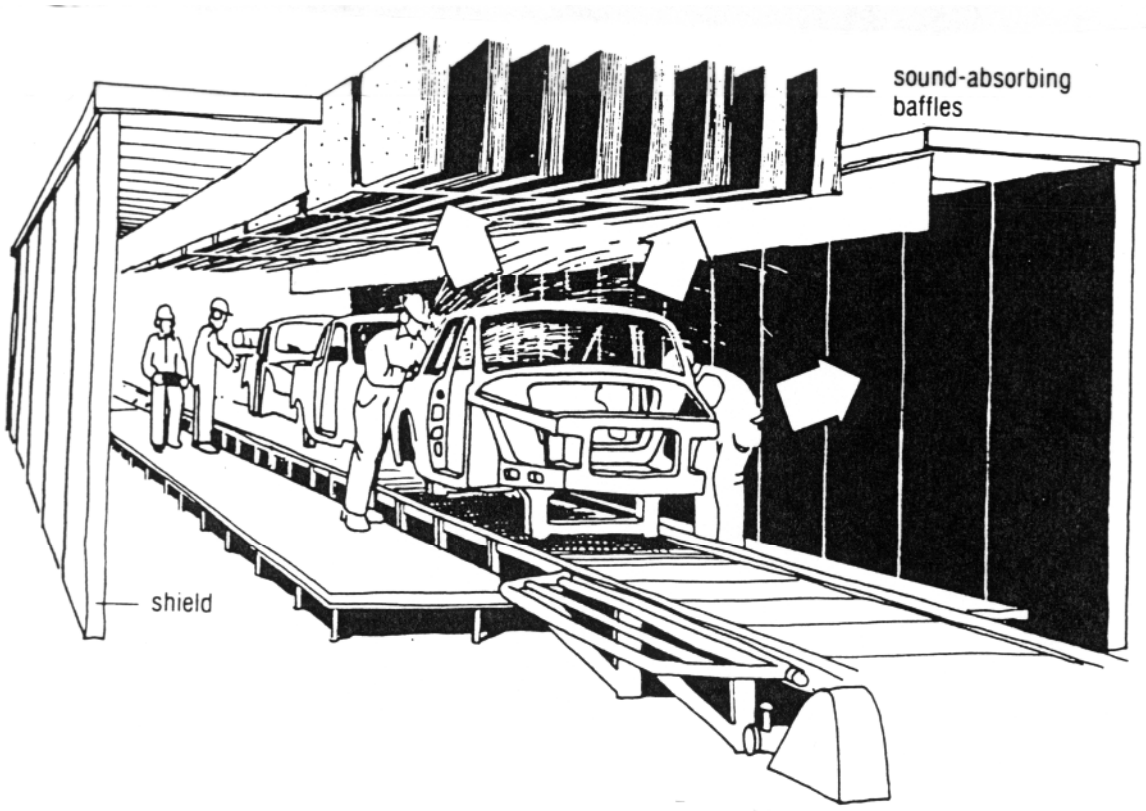


Control:

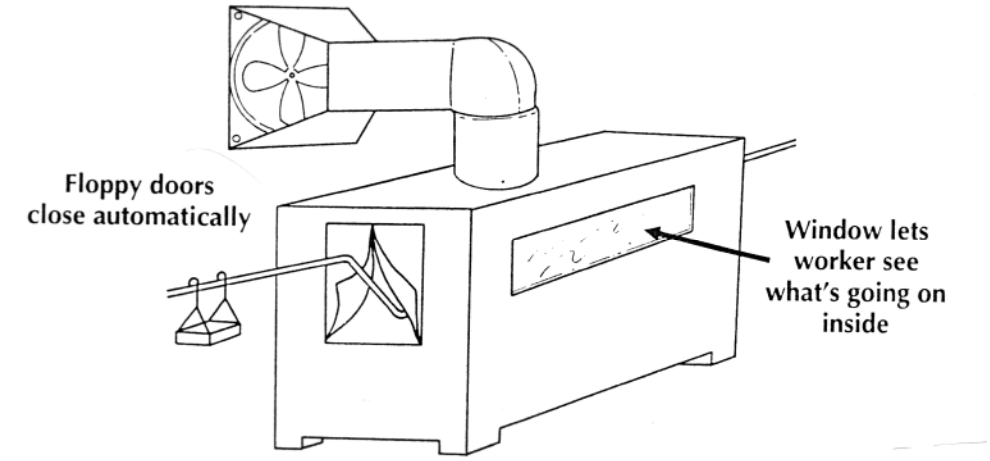


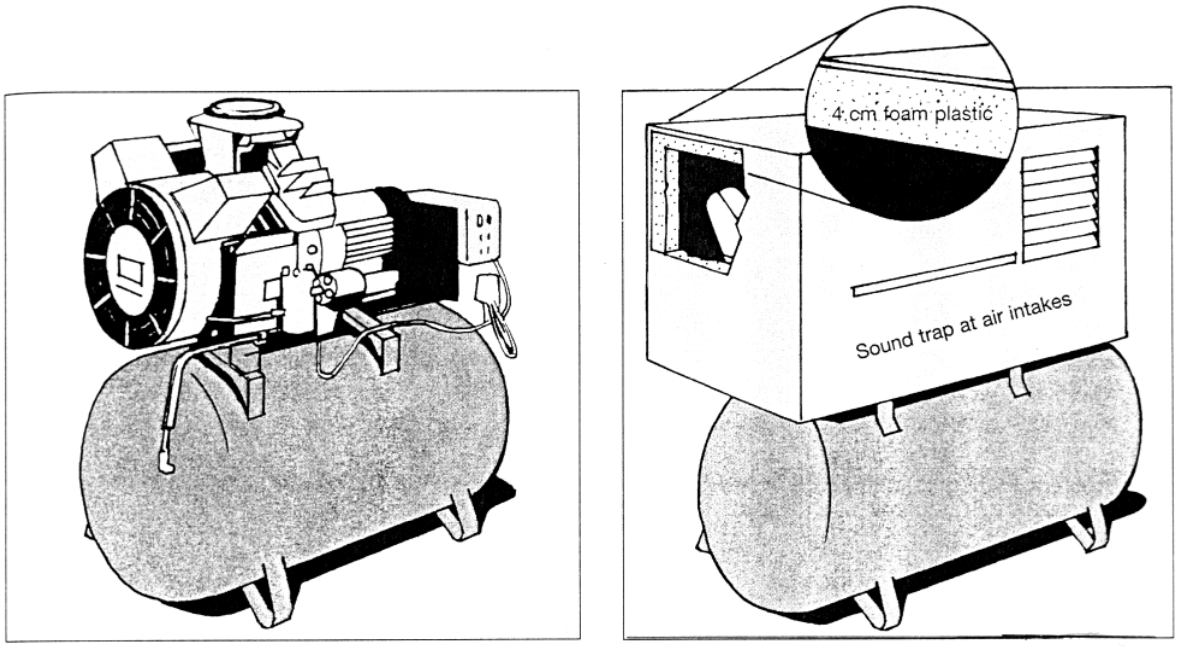
Example of Noise Engineering Control

Noise is trapped and absorbed in “baffles” or panels in ceiling



Examples of Enclosed Processes

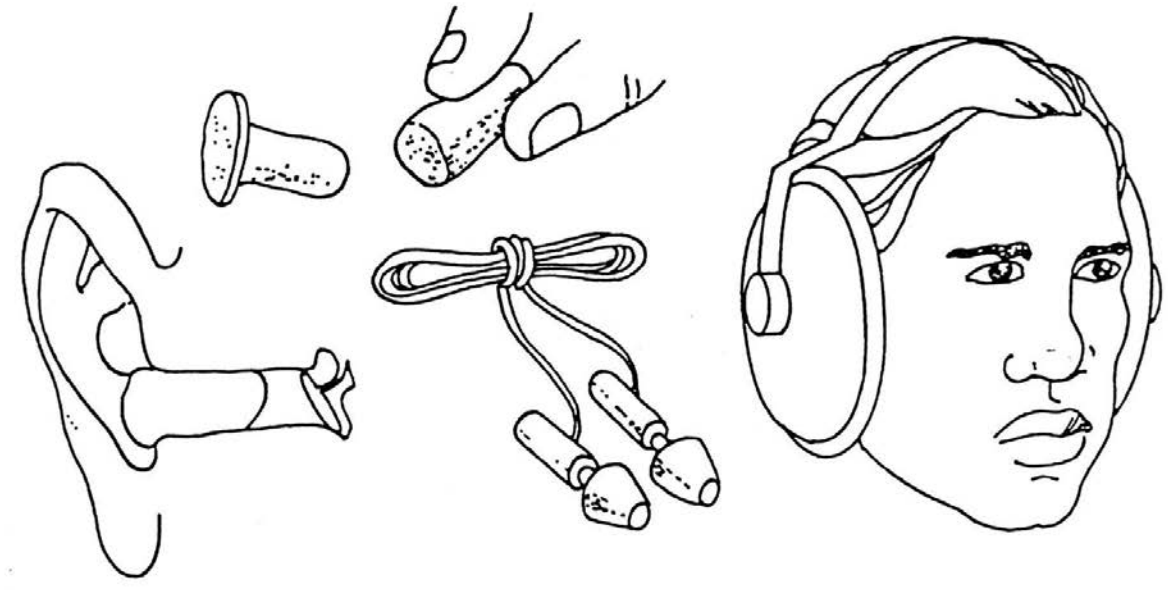




Noise-insulated air compressors. The principle is that the noise should be contained under the hood. The hood is made of hard material with a soft, absorbent lining

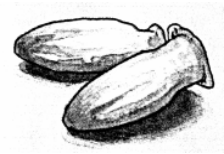
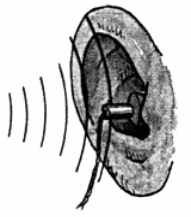
Administrative controls for noise reduction include rotating workers in and out of area with high noise levels, and providing training to workers about noise hazards and ways to reduce noise exposures and protect hearing.

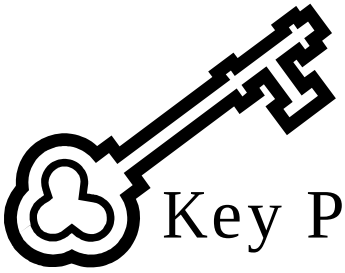
Personal protective equipment (PPE) for noise reduction includes ear plugs and ear muffs. Like all PPE, this control depends on selecting the correct equipment for the specific noise levels, and proper use and care of the equipment. It is important to recognize that the noise is still present, and that the PPE (if used correctly) simply reduces the amount of noise reaching the inner ear.



Some users of hearing protection equipment have developed serious ear infections that have damaged their hearing, so workers should be sure to report any health problems resulting from the use of PPE.

Ear Plugs and Ear Muffs

Types	How They Work		Use and Care	Comfort Tips
 **Disposable Plugs**		Disposable plugs come in a variety of styles. All are placed inside the ear canal to block out noise. Plugs are almost invisible and also help prevent dirt and grease from entering the ear.	Wash your hands and inspect plugs for wax, dirt, or grease before inserting them. Some disposable plugs need to be shaped before you use them. Don't share plugs. Throw plugs away after your shift.	Plugs should be pliable and fit snugly into the ear canal. Never break off the tips. After inserting plugs, if they work, your voice should sound louder to you.
 **Reusable Plugs**		Reusable plugs come in a variety of styles and fit into the ear canal to block out noise, dirt, and grease. Some plugs come in pairs joined by a string so they are not easily lost.	Wash hand and inspect plugs for dirt and grease before using. Wash reusable plugs at least once a day; rinse and dry. Store in a plastic case or clean pill bottle, Replace them when they harden or become discolored.	Plugs should fit snugly into the ear canal. Try different kinds to see which are most comfortable. Check the fit of reusable plugs the same way you check disposable plugs.
 **Headband Plugs**		Headband plugs provide a snug yet comfortable fit. They can be worn along with safety glasses, helmets, or other headgear. They are, in many ways, more versatile than muffs. However, earmuffs are more protective than earplugs.	Headband plugs are made of washable materials and should be cleaned often. Although they are durable and long-wearing, they mustn't be subjected to twisting or bending. Store them safely.	The headband ensures uniform pressure on the ear tips. Again, don't bend the headband; this will interfere with the performance of the protectors. If you experience any problems, see your supervisor.
 **Muffs**		Earmuffs have cushions that form a seal around the ear, covering it completely and blocking out noise. The ear cushions may be foam- or liquid-filled.	Keep muffs clean by washing the cushions. Since the cushions may harden with use, periodic examination will determine the need for replacement. Store muffs in a safe place, such as a shelf or a locker.	All muffs should be fitted carefully for maximum comfort. Don't loosen muffs, that will reduce their noise-reduction efficiency. If you wear glasses, muffs may not fit properly, you'll need another type of ear protector.



Key Points

1) High noise levels in the workplace cause injuries and illnesses.

2) Noise levels can be precisely measured, and the employer is required to do so.

3) Various types of controls can reduce noise levels, and the employer is required to do so for levels above 85 dBA for an 8-hour shift.

Noise Exposures

Equipment: flashlight, tape measure, sound level meter

OBSERVE OR MEASURE

1. Pick four areas. Measure the sound level: at the machine operator's position, and at the work station of the nearest worker.

	Machine/Area	SLM reading (in decibels)	Hearing Protection in Use?	Number of employees exposed
A.		*Operator:* *Closest worker:*	” Yes ” No ” Yes ” No	
B.		*Operator:* *Closest worker:*	” Yes ” No ” Yes ” No	
C.		*Operator:* *Closest worker:*	” Yes ” No ” Yes ” No	
D.		*Operator:* *Closest worker:*	” Yes ” No ” Yes ” No	

ASK WORKERS

2.

	Were Sound Level Meter readings taken?		Has personal monitoring been conducted?		Have employees had a baseline and annual audiogram?	
Area A	” Yes ” No	When:	” Yes ” No	When:	” Yes ” No	Last test date:
Area B	” Yes ” No	When:	” Yes ” No	When:	” Yes ” No	Last test date:
Area C	” Yes ” No	When:	” Yes ” No	When:	” Yes ” No	Last test date:
Area D	” Yes ” No	When:	” Yes ” No	When:	” Yes ” No	Last test date:

ASK SUPERVISORS OR MANAGERS

3.

	Were Sound Level Meter readings taken?		Has personal monitoring been conducted?		Have employees had a baseline and annual audiogram?	
Area A	” Yes ” No	When:	” Yes ” No	When:	” Yes ” No	Last test date:
Area B	” Yes ” No	When:	” Yes ” No	When:	” Yes ” No	Last test date:
Area C	” Yes ” No	When:	” Yes ” No	When:	” Yes ” No	Last test date:
Area D	” Yes ” No	When:	” Yes ” No	When:	” Yes ” No	Last test date:

Ask management for the following documents:	Are these documents available?
4. Records of Sound Level Meter results	” Yes ” No
5. Records of personal monitoring results	” Yes ” No
6. Records of employee audiogram results	” Yes ” No
7. Records of employee training on the harmful effects of noise	” Yes ” No

Notes